Science objectives: Geomagnetism from stratospheric platforms

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Potential science objectives

- Resource estimation, deep crustal structure
- Monitoring South Atlantic anomaly and North pole. Space weather observatory
- Monitoring currents induced by sub-ice circulation
- Crustal deformation and faulting. Natural hazard observatory.
- Stratospheric/atmospheric processes with magnetic signatures.

Example 1: Resource estimation, deep crustal structure

- What is the nature of the middle and lower crust? Structure, depth to magnetic source, location of source, magnetization directions, conductivity distribution.
- Two thrusts: adding intermediate wavelength information to existing surveys. And surveys of unexplored areas with difficult access (Bangui, Antarctic…)

Example 1: Resource estimation, deep crustal structure

- Science and measurement requirements: Simultaneous measurements of magnetic field with 2 km vertical or possibly horizontal separations to infer magnetization and conductivity distribution. Multiple tracks separated by 35 km.

Example 1: Resource estimation, deep crustal structure

- Instrument approaches: Total-field magnetometer would suffice for magnetization distribution. Vector-field magnetometer would be required for conductivity distribution. 1 Hz. Possibilities might include self-calibrating Scalar-Vector helium magnetometer under development in NASA IIP. Not real-time

Example 1: Resource estimation, deep crustal structure

- Platform options: 10-20 kg instrument mass, 2-4 W instrument power requirements. One or two platforms, depending on whether horizontal or vertical gradients are used. Platform shouldn’t rotate at more than 1 rpm.

Example 2a: Monitoring South Atlantic anomaly. A space weather observatory

- A single observatory located in the South Atlantic to monitor space weather conditions within the South Atlantic anomaly and provide timely warnings to polar-orbiting satellites. Monitor the expanding and deepening South Atlantic anomaly. If long-term, monitor core processes producing main field decrease.

Example 2b: Monitoring North Pole. A space weather observatory

- A single observatory located over the geographic North Pole to monitor space weather conditions. Provides data for comparison with existing South pole magnetic observatory.

Example 2: Monitoring South Atlantic anomaly and North pole. Space weather observatories

- Science and measurement requirements: Total and/or vector magnetic fields samples at 20 Hz. Stay within 1 x 1 degree of Lat/Lon. Probably including radiation monitors. Real-time (1 minute) data needed. Arc-second pointing knowledge required for vector magnetometer. Highest altitude possible to get closest to affected satellites.